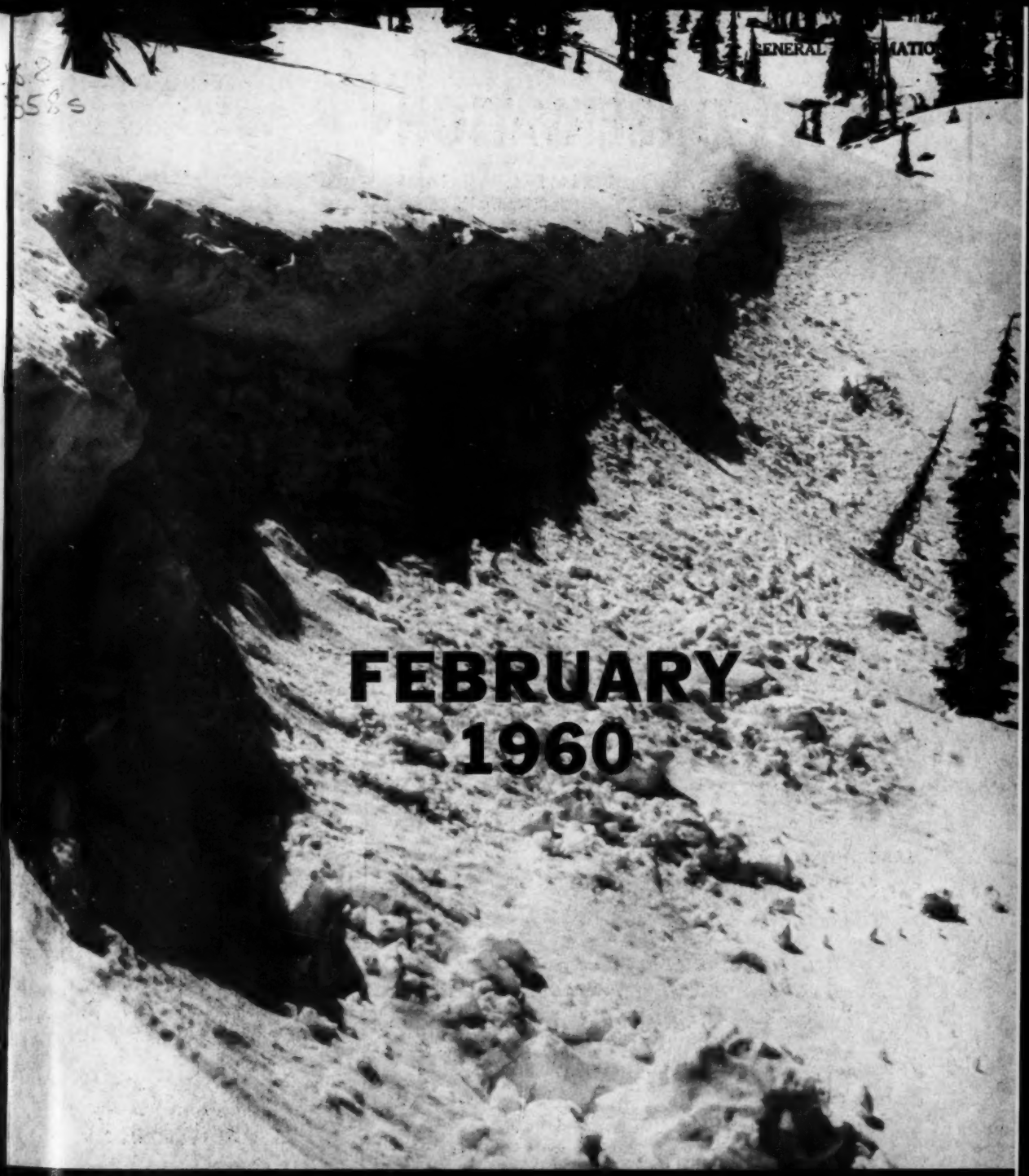

FEBRUARY
1960

SOIL CONSERVATION

Soil Conservation Service • U. S. Department of Agriculture

SOIL CONSERVATION

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U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

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★ THIS MONTH ★

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TOM DALE, Editor

SOIL CONSERVATION is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business. The printing of this publication has been approved by the Bureau of the Budget, June 26, 1958. SOIL CONSERVATION supplies information for workers of the Department of Agriculture and others engaged in soil conservation.

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BALING GRASS SILAGE.—A year of tests with baled grass silage at Minnesota experiment stations indicates that this may be a practical way of dealing with wet hay crops.

In the tests, the hay was baled with 35 to 50 percent moisture content. The bales were closely stacked on one end of a sheet of plastic. The plastic sheet was then pulled over the stack and the ends and edges covered with enough soil to make the entire stack airtight.

Wherever the plastic sheets were not punctured, the baled silage was still good when the stacks were opened for winter feeding. In one test the total dry matter losses were less than 5 percent.

In all tests, however, the baled silage had some white mold on it, due to the trapped air in the plastic bags at the time of sealing. But apparently this mold did not affect the quality of the silage and may have improved its palatability, since cattle seemed to relish it.

The silage spoiled, however, where the plastic was torn or punctured. There were also problems in opening and feeding the silage. Once the plastic was opened the entire surface was exposed to air and hence created a spoilage problem if the temperature rose above 40 degrees.

FRONT COVER.—Snow drift near McKenzie Pass in Deschutes County, Ore.

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Water Diversion Through Snowbanks

By Carl Wilker

THE problem of bringing water economically through snow banks, sometimes 20 to 30 feet deep, to irrigate Utah's Sanpete Valley has been solved by using 6-inch perforated metal pipe. As a result, several irrigation companies now are supplementing their water supply by canal diversions from the Colorado River Basin to the Sanpete Valley. These transmountain canals lead melting snow water from the east slopes through mountain passes or tunnels at elevations of approximately 10,000 feet. In some instances this is the only water available for land that has been irrigated by transmountain water since the 1860's.

Many thousands of dollars were spent by the Mormon pioneers who developed these transmountain projects. Descendants of the early pioneers state that nearly a quarter million dollars was spent by a few individuals on the less than half a mile long Larsen tunnel above Ephraim, Utah. The largest tunnel in the area is the Ephraim tunnel, nearly a mile long, that was constructed with financial and technical assistance from the Bureau of Reclamation at a cost of approximately one-half million dollars.

Canals leading to the tunnels and low mountain passes are several miles long in some instances. Most of the canals were dug with 2 to 3 percent grades, cutting across slopes and natural drainageways where they intercept runoff from melting snow. The initial construction was done by hand labor or with horse-drawn equipment.

In early spring when temperatures permit thawing, snow begins melting rapidly on the south and west slopes, canals begin filling in the early afternoon, and snowbanks lying across canals must be opened or water overtops the canal banks. When a canal breaks the entire stream may be lost for several days in addition to the severe erosion damage that is caused by the break. The only practical method of repairing these canal breaks at this time of year is by manual labor, and the laborers usually must climb several thousand feet on foot or by horseback to get there. But the canals must be opened and breaks repaired, since the crops in the valley 5,000 feet below begin thirsting for water around June first. These melting snowbanks are their only source of water, and when they are gone the fields remain dry until the following spring.

Farmers tried many devices through the years to open these canals through the snowbanks in early spring. Logs were anchored to

Planks and poles were used in this diversion canal to prevent its being clogged by snow drifts.

Note.—The author is work unit conservationist, Soil Conservation Service, Manti, Utah.

the banks of the canals by wire in hopes the melting water would follow the log and open a hole through the snow. Some companies covered the worst drift sections of their canals with lumber slabs or planks. One company used 6-inch wooden pipe, such as was commonly used in some of the early city water systems. Another company constructed square wooden boxes (approximately 1 foot by 1 foot) in 12- to 16-foot sections and fitted the sections end to end.

These methods were all helpful but many man-hours were still spent shoveling snow and working the water through the drifts by hand labor. Water was late getting to the tunnels on years when snow was deep and hundreds of acre-feet of water were lost to the Sanpete farmers.

In 1955, a large irrigation company applied to the Sanpete Soil Conservation District for technical assistance on its snowbank problems. SCS engineer Thomas M. Brothersen and I visited the problem area with Evan C. Larsen, then president of the irrigation company. Their canal, located on what is called Horseshoe Flats, was inspected from the Larsen Tunnel eastward to the beginning of the canal. Problems were discussed and a conservation plan was worked out with the company.

Easements and rights-of-way were cleared with the Forest Service, and an agreement was reached to begin improvement of the canal. One section of the canal was surveyed and found to be too flat, so a new channel was recommended by SCS and constructed by the company to obtain better gradient.

Wooden box pipe used to carry early runoff through snow banks.

Twenty-four-inch metal pipe installed in Olsen's Canyon by a large irrigation company to lead water through snow drifts.

SCS technicians in the district knew of no former experience or methods prescribed to get the water through the snowbanks, but agreed on Tom Brothersen's recommendation that metal pipe should solve the problem. The size pipe to use was based on the capacity of the canal, and a spillway to control this capacity was installed at the head of the pipe. Accordingly, 630 lineal feet of 24-inch galvanized, corrugated metal pipe was installed by connecting each 20-foot section with metal bands and laying it in the bottom of the new canal. This canal was on an east slope where the deep drifts accumulated.

Performance of this pipe was checked early during the 1956 spring thaw. The method worked and, for the first time in years, a good stream was coming out early from under several feet of snowbank.

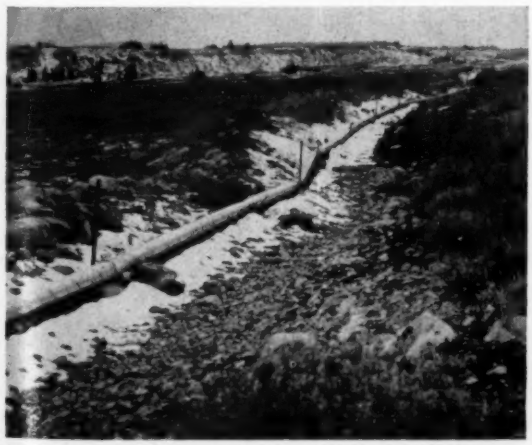
Observations were made by SCS technicians and findings were discussed with members of the irrigation company board. It was noted that a tunnel larger than the 24-inch pipe had opened up through the snowbanks. Indications were that smaller pipe could be used and would do the job. We now reasoned that 6-inch galvanized, perforated metal pipe should open up the channel by leaking water along the canal bottom, thus melting the snow and opening the

channel for a stream to flow through the snowbank. Once a small channel was open the stream of water from the melting snow should rapidly open the channel to full capacity.

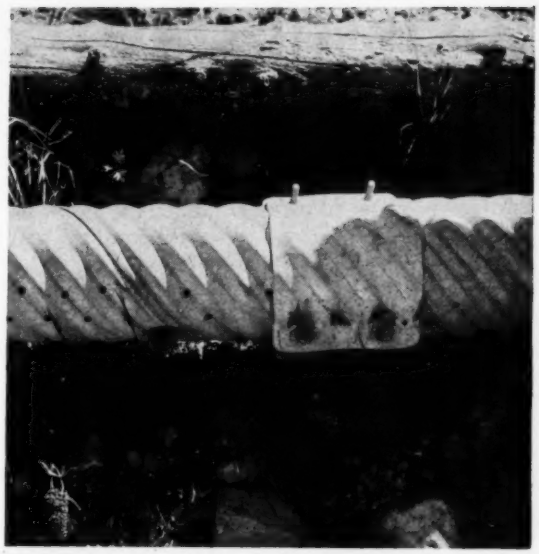
The ideas and results were explained to a local canal company, which operates a canal system in the same general area. This company, with SCS technical assistance and ACP cost-sharing provided by the County Agricultural Stabilization and Conservation Committee, installed 2,000 feet of 6-inch perforated pipe in the fall of 1956. This pipe was located and placed in critical sections of the canal which were spotted and staked the preceding spring while the snowbanks were still in place.

This 6-inch perforated pipe seemed as effective in getting the water through the banks as the larger pipe. It also had the advantages of being much cheaper and easier to transport into this high, rough, mountainous country. However, such pipe must be properly located and supported in the channel to prevent silting up and to prevent crushing from the settling snowbanks.

Several irrigation companies now are using this method to lead water through deep snowbanks. Advantages, as expressed by them, are: (1) labor to get water through the banks is eliminated almost entirely if pipe is properly installed; (2) water can be brought through tunnels as much as 2 weeks earlier in the spring; (3) erosion of canal banks and steep mountain slopes caused by canal breaks is reduced almost 100 percent; (4) canal maintenance costs are greatly reduced; and (5) more water is provided to the stockholders of the companies.



Six-inch perforated metal pipe, in Horseshoe Flat diversion canal, that is held in place with steel posts.



Perforations in 6-inch metal pipe permit water to escape and melt the interior of snowbank, thus opening channel for canal stream flow.

What is water worth?

Water is a commodity so precious that no tyrant has ever dared deny it to his people. The earliest records of our civilization are linked to the spring and the waterhole, the river, and the well.

Wars have been fought over water rights and once-mighty nations have vanished because their water resources failed. Men have battled to the death over the last few drops in a canteen. Formidable fortresses, impregnable in other respects, have fallen because of an insufficient water supply.

Ships' masters have had to risk the destruction of their vessels and the slaughter of their crews because water shortages forced landings on savage isles. Families have given up their homes and deserted their properties because of failing wells and dried-up watercourses. London was virtually destroyed by fire in the 17th century and Chicago reduced to ashes in 1871 because sufficient water could not be delivered to the right place at the right time.

What is water worth?

Water is beyond price—so far beyond price that water is free of all price.

Reprinted from What Price Water? American Waterworks Association.

Should You Let The Grass Grow?

By A. A. Hanson

HOW much, how often, and when should you mow or graze perennial grasses to get maximum forage production and still maintain vigorous future growth? The answers vary according to the kind of grass, the climate, soil, type of use, and other factors. No set of answers will fit all situations.

The perennial grasses form the basis of our natural and seeded ranges and pastures and are major constituents in most hayfields. They are important as livestock feed and make direct and indirect contributions to erosion control, improved soil fertility, landscape beautification, and wildlife cover. Yet these plants, by virtue of demands for livestock feed or for close, frequent mowing, often serve as one of our best examples of man's many attempts to have his cake and eat it too.

Most crop plants complete all or a substantial part of their life cycle before being harvested. On the other hand, the perennial grasses may be harvested or clipped not once, but several times during a single growing season. In addition, they are expected to persist and maintain their productivity year after year. All too frequently these plants are utilized with little or no attention to the season of the year, fertility requirements, drainage needs, drought conditions, and intensity of defoliation. Have we any reason to wonder, then, at the poor stands, erosion conditions, weed invasions, and low yields that are encountered on so many grassland acres?

Substantial improvement can be made through the choice of species and varieties for reseeding, by the use of fertilizers, and by good drainage. Nevertheless, we are left with the paradox that our returns from grasslands, whether they be beef or beauty, depend on grazing or clipping the grass during the growing season; yet this defoliation may be to the detriment of thick stands, total yield, and erosion control value.

It is obvious, therefore, that proper management of the perennial grasses depends on a thorough understanding of the effects of top-removal on subsequent growth and development. The following remarks will be confined to some of the major factors influencing recovery following top-removal, for the simple reason that space does not permit an exhaustive review of these complex and somewhat poorly understood phenomena.

The rate of recovery after harvesting or mowing is a function of two sets of variables: those reflecting the condition of the grass plant, and those associated with the environment in which it is growing. The plant factors are: (1) the amount of leaf area (photosynthetic surface) that remains after clipping or grazing; (2) the amount and location of reserve substances (carbohydrates stored in the roots, at the base of the stems, or in stolons or rhizomes); and (3) damage or removal of the shoot apex (the growing point that eventually becomes reproductive and develops flowers and seed). The environmental factors include moisture, soil fertility, temperature, and light.

Any one of these may have a significant influence on regrowth, depending on the species, frequency of defoliation, and height of cutting or grazing. However, the level of reserve sub-

Note:—The author is research agronomist, crops research division, Agricultural Research Service, Beltsville, Md.

No. 51

This is the fifty-first of a series of articles to appear from time to time in explanation of the various phases of research being conducted by the Department of Agriculture on problems of soil and water conservation.

stances in the grass at the time of defoliation is of primary importance to subsequent plant response.

The grass plant is placed under stress as soon as the top growth is removed. The basic significance of reserve substances to regrowth and survival is not unlike the situation prevailing when grasses are exposed to unfavorable environmental conditions. Thus, the success with which dormant grass plants survive periods of low temperature or extreme drought is determined somewhat by the level of reserve materials.

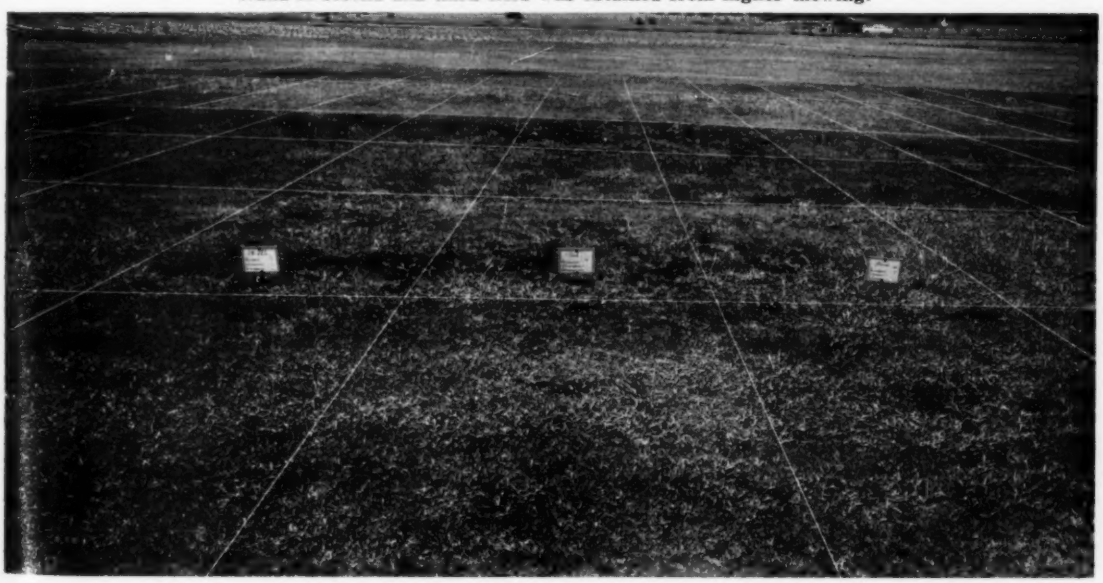
Leaf expansion following complete defoliation is normally at the expense of stored reserves. At the same time, root growth ceases until the photosynthetic area increases and sufficient carbohydrates are manufactured for root development. Under some circumstances as little as half as much soil moisture may be available to defoliated plants as to nondefoliated, transpiring plants. Reduced root activity prevents extension of roots into regions not already depleted of soil moisture and also reduces the uptake of mineral nutrients.

The stem dies when the shoot apex is removed by grazing or mowing. New growth must come either from buds located at the base of the stem or from rhizomes, stolons, or roots. Under field conditions, loss of the shoot apex from erect growing grasses may remove a much larger portion of the photosynthetic area than utilization of similar plants without loss of the shoot apex. In addition, removal of the shoot apex may coincide with a period of low reserve substances. If this is true, then the growth of new buds will be slow or the plant may die because of insufficient reserves, reduced root development, and the associated lack of moisture and nutrients.

The amount of photosynthetic area left after clipping or grazing will determine the need for and amount of reserve substances used to initiate new growth. Complete defoliation of a low-growing species like Kentucky bluegrass is practically impossible unless cutting is very close and at infrequent intervals. Kentucky bluegrass and such low-growing species as carpetgrass, bermudagrass, and buffalograss can maintain sufficient foliage under moderately heavy use to accumulate adequate reserves. The buildup of reserve substances cannot be taken for granted, however, even in a low-growing species.

For example, the top growth of Kentucky bluegrass can be overstimulated in late spring

Kentucky bluegrass-red fescue mixture test plots on height of mowing and fertilizer treatment effects. Thin turf in first tier of plots is due to close mowing or to close mowing plus overstimulation with nitrogen. The superior stand in second and third tiers was obtained from higher mowing.



Completely defoliated smooth brome tillers, showing type of recovery when shoot apex is not removed (C) and when shoot apex is removed (D).

by heavy applications of nitrogen, and then the frequent mowing necessitated may retard the accumulation of carbohydrate reserves and root development. Under these circumstances, loss of stand can result from lack of sufficient reserves to maintain plants through periods of drought and high temperature.

There are also wide differences among varieties as illustrated by the comparison between the low-growing Merion variety and common Kentucky bluegrass, or by the comparison between a turfgrass variety of bermudagrass, such as Tifgreen, and the forage variety, Coastal.

The relationship of top-removal to photosynthetic area cannot be considered without reference to the location of reserve substances. In many species (e.g., crested wheatgrass and orchardgrass) a substantial amount of the reserves is stored in the stem bases and may be removed in part by very close clipping or grazing. Reserves stored in roots, rhizomes, and stolons are protected from this hazard.

Reserve substances can compensate to a large degree for the loss of photosynthetic area, removal of the shoot apex, and cessation of root growth caused by top-removal. If water management and soil fertility practices are improved insofar as practical, then a knowledge of reserve substances, when they are accumulated, and when they are at critically low levels holds the key to sound management practices.

In many grasses the maximum level of food reserves is reached either after stem elongation has ceased or at maturity. Thus, reserve carbohydrates in purple needlegrass accumulate as the growth velocity decreases, at or near the end of the annual growth cycle. The pattern is very similar in mountain brome, slender wheatgrass, johnsongrass, and vaseygrass. In little bluestem, organic reserves in the roots usually decrease up to the time of flowering. Reserves accumulate in timothy during the growing season, reach maximum levels at blooming, and then remain fairly constant until late fall when they start to decline. In the fall, carbohydrate reserves increase in Kentucky bluegrass and orchardgrass.

Reserves in the perennial grasses are usually low in the spring as a result of depletion during the winter. Rapid spring growth, coupled with little or no basal leaf development, does not permit the restoration of reserves. Hence, species with this growth pattern are invariably subject to damage from heavy spring use. Grasses in this category are meadow fescue, tall oatgrass, and purple needlegrass.

In early spring other species, such as smooth brome, may form a rosette of basal leaves which will permit the restoration of some reserves during cool weather. Stem elongation occurs very rapidly, however, and apparently utilizes reserve substances in the process. Therefore, the critical period for smooth brome is rather short and appears to be closely associated with the elongation of the lowest internode of the stem.

The success of crested wheatgrass in the Northern Great Plains and Intermountain Region can be attributed in part to its strong ability to maintain high reserve levels in roots and stem bases even though root growth, total yield, and plant size are reduced by top-removal.

Orchardgrass, tall fescue, Russian wildrye, blue grama, Coastal bermudagrass, and Pensacola bahiagrass are adapted to very different environmental conditions. Yet they represent

species and varieties in which reserve substances can be maintained during the growing season when the plants are subjected to periodic grazing or clipping. They differ markedly from species in which reserve substances remain at relatively low levels until late in their growth cycles. These latter species may be severely damaged by what would be considered moderate use during the vegetative stage, especially if such use coincides with drought periods.

What happens when the perennial grasses complete their seasonal growth cycle without clipping or grazing? In general, grasses subject to damage from top-removal maintain stands and appear to perform very satisfactorily. On the other hand, grasses that can tolerate some degree of defoliation may perform much better if they are clipped or grazed. This is particularly true in humid regions where the presence of mature foliage and accumulated litter contributes to the buildup of insect pests and disease.

It all adds up to this: you must know your grasses and the environmental factors involved before you can make sound determinations as to how much, how often, and when to mow or graze.

Latar Was The Answer

By Leonard A. Anker

THE supervisors of the Carson Valley Soil Conservation District had heard that "Latar" was one of the best grasses that Soil Conservation Service agronomists had developed at the nearby plant materials center, and they wanted someone to try out this variety of grass. They wanted a first class farmer with some Class I land, so they looked up Frank Settelmeyer and his son, Marvin, who operate an 80-cow dairy near Genoa, Nev. If this new variety of orchardgrass was as good as they had heard, it could really help farmers in their district, they figured.

Note:—The author is work unit conservationist, Soil Conservation Service, Gardnerville, Nev.

Marvin Settelmeyer displays cuttings of common orchardgrass, alfalfa, and Latar orchardgrass made at the time common orchardgrass had formed seed heads. The alfalfa and Latar are still in vigorous growth and will be ready to produce optimum hay yield at about the same time.

Orchardgrass is seldom grown alone. A favorite combination for dairymen is orchardgrass planted with alfalfa. Many dairymen, like the Settelmeyers, say it makes a better feed, helps prevent bloat, and is about the most palatable grass that can be grown on irrigated lands. That is, it's palatable if cut for hay before it gets too old and coarse. But that was a fault of common orchardgrass. When planted with alfalfa it matures a couple of weeks before the alfalfa is ready to cut. Many farmers say they were faced with this dilemma—should they cut the alfalfa before it's ready, or should they let the orchardgrass go and cut it when the alfalfa is at peak quality.

Darwin Anderson, SCS plant materials technician working in Nevada, told them that Latar orchardgrass was the answer. "It will mature about 10 to 14 days later than common orchardgrass and should be ideal to plant with alfalfa," he said. So they called on the Settelmeyers to prove it. They did just that.

About 6 acres of Latar orchardgrass were planted alongside a larger field of common orchardgrass in the fall of 1956. Both were seeded with alfalfa. The Latar field looked good in 1957, and when we saw the crop in 1958, we knew we had picked the right farmers and the right grass. It was just as pretty a

Chopped alfalfa and Latar hay being fed to the milk cows on the Frank Settelmeyer & Sons farm.

field as you'd want to see—thick as hair on a dog's back.

Not only that, but these good dairymen know that quality hay is not measured in pounds but in the amount of milk cows give. The Settelmeyers don't sell hay. Their money comes from their milk checks.

"Latar orchardgrass matured right along with the alfalfa, and it seemed to be quite a bit leafier, too," Frank Settelmeyer mentioned.

The Settelmeyers even learned something the SCS technicians didn't think of. They cut their hay with a windrower. Each time the reel in front comes around, it throws the grass pollen back near the operator. Marvin told us that there were times when he was just yellow—covered from head to toe with pollen. That is, with the common orchardgrass. With the Latar variety there was much less pollen because it matured later. What a boon that could be to anyone who has hayfever troubles.

Grass Makes the Difference

—in Rainfall Penetration of Grazing Land

By Leon J. McDonald

THE amount of grass on rangeland makes a big difference in the amount of runoff and insoak from flash rains, in the opinion of I. C. Thurmond, Jr., of Elk City, Okla. And he has observations and measurements to prove his point.

Thurmond operates the 11,400-acre Red Rock Ranch northwest of Elk City. He has been a cooperator with the North Fork of Red River Soil Conservation District for years. He nearly always confers with SCS range conservationist Fred Whittington before making major changes in his ranching operations. And he is beginning to see his conservation ranching methods pay off.

Native grasses, such as sideoats grama and the bluestems, blanket most of the ranch. The grass is getting thicker and taller on most of these red shale hills year by year. The cowherd looks thriftier and the calves are heavier at weaning time. Thurmond has seeded 2,500 acres of formerly cultivated land to native grasses in recent years.

Most of Red Rock ranch lies within the Sandstone Creek watershed protection and flood prevention project. Some of the drop-

Note:—The author is assistant State conservationist, Soil Conservation Service, Stillwater, Okla.

inlet structures and floodwater detention dams are on the ranch. Thurmond visits these sites frequently and has observed that the water runoff is less since he started his grass management program. The water in the lakes is clearer than when they were built in the early 1950s. The rancher knew that "grass made the difference" but he did not know how much difference. He wanted to know, and the matter usually came up for discussion when he and Whittington got together.

He did not have to wait long before Whittington had convincing proof of the value of a grass cover on the rate and amount of infiltration. One night, 1.65 inches of rain fell in a 1½-hour period. Whittington and Dent Burgess, SCS soil scientist, got Thurmond and drove out to the ranch to check on runoff and infiltration.

The men found an area typical of the ranch, where the amount of grass cover varied greatly. Whittington and Burgess took turns digging holes with a sharpshooter spade while Thurmond looked on. The results were soon evident and amazing.

On Site (1) where the range was in Poor condition and grass cover was sparse, the moisture had penetrated only 3 inches. There was evidence that most of the water had been lost through runoff.

At nearby Site (2) where the range was in Fair condition, the insoak penetrated to a depth of 10 inches. There was little evidence of runoff from this area.

Nearby, Site (3), a dense stand of sand bluestem in Excellent condition, showed a moisture penetration of 30 inches.

Thurmond looked and believed what he saw. There was convincing evidence that the amount of grass cover and the depth of moisture penetration were closely related; the greater the amount of cover, the greater the depth of moisture penetration.

In the limestone area of southern Oklahoma, Chester Fry, SCS range conservationist, made similar findings near Ardmore. On a range in Poor condition and badly overgrazed, Fry found the water intake was only 4 inches in a 2-hour period of steady rainfall. The intake was 1.2 inches the first 15 minutes of the test, but only .2 inches the last 15 minutes of the period.

The intake was 10 inches in the same 2-hour period on a nearby range in Excellent condition and properly grazed. The rate of intake varied from 2 inches the first 15 minutes to 1 inch the last 15-minute period.

Fry also found that the amount of cover on the land influenced the temperature of the soil. On the range in Poor condition, the soil temperature—2 inches below the surface—was 135°F. as compared to a temperature of 95°F. on the site in Excellent condition. The air temperature was 105°F. at this time.

On Thurmond range in Poor condition moisture penetration was only 3 inches after 1.65 inches of rainfall (above), while moisture penetrated 30 inches on range in Excellent condition (below).

A Part-Time Farmer

Builds up a Rundown Farm

By Edward G. Konieczny

REVIVAL of a rundown farm on a part-time basis was a challenge to William W. Hamilton, a machine shop worker of New Salem, Mass. His family felt the challenge, too. The 130-acre farm, obtained in 1946, consisted of 25 acres of orchard, 90 acres of woodland, and 15 acres of idle land.

"Putting the farm into production so that I'd have a reliable supply of fruit to sell was my first job," Hamilton recalls. "I had always hoped that I could market my fruit on a 'pick-your-own' basis but I had to have the fruit to keep the customer coming back. That's where the Soil Conservation Service came into the picture. In 1953, with the help of the SCS technician assigned to the Franklin Soil Conservation District, I made a soil and water conservation plan for the farm. The soils map helped by showing me where the different kinds of fruit would grow best."

Note:—The author is work unit conservationist, Soil Conservation Service, Greenfield, Mass.

William Hamilton checks mulch and growth in his contoured strawberry bed.

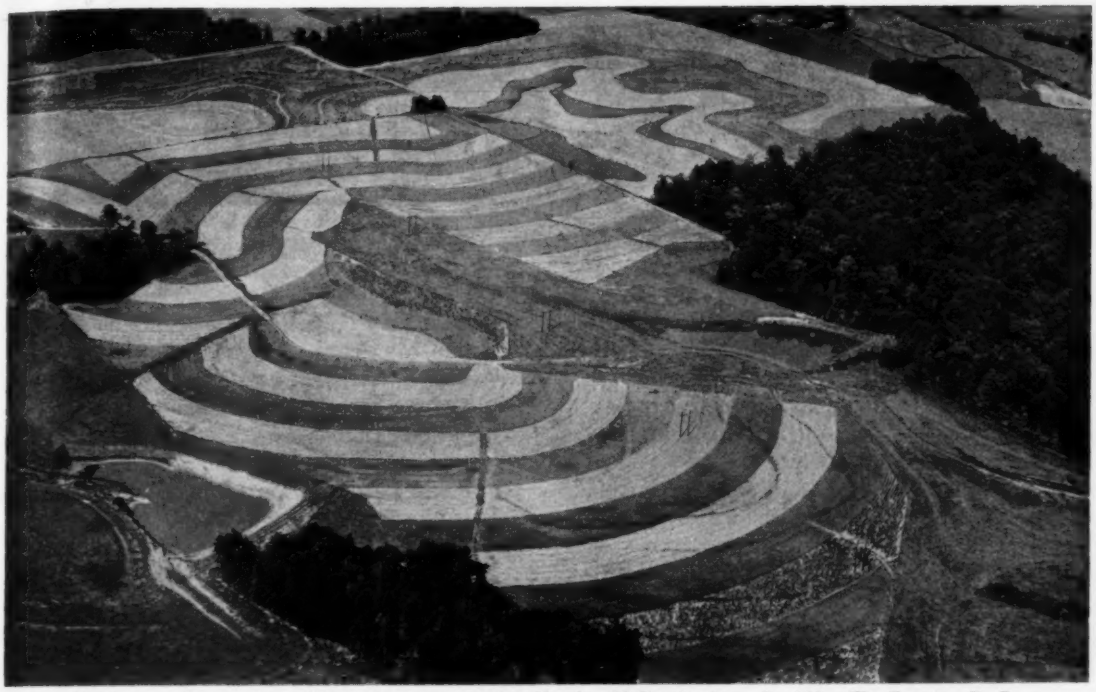
Hamilton started work on making the idle land productive by installing 1,035 feet of diversion ditches. They prevented excess water from flowing across the 15-acre sloping field. He built the ditches with his farm tractor and plows. SCS technicians checked the grade of the diversions periodically as Hamilton plowed them in the evening after his day's work at the machine shop.

He seeded Kentucky bluegrass, redtop, and white Dutch clover when the completed diversions were ready to do their job. He seeded green manure crops of red clover, alsike clover, and timothy between the diversions to increase soil organic matter. After turning the green manure crop into the soil, he planted 3 acres of peaches and pears, 2 acres of strawberries, and 1 acre of raspberries on the contour. He rotates 4 acres of strawberries and vegetables every 2 years with green manure crops.

"Contouring and mulching help a lot in conserving water in the Gloucester fine sandy loam soil that makes up the farm but the crops need some additional water during dry seasons," Hamilton said. So he built a quarter-acre pond for irrigation of small fruits. The four Hamilton children, 4 to 11 years of age, enjoy swimming and wading in the pond during hot summer days. Mr. and Mrs. Hamilton watch out for their safety.

The Hamiltons now market their fruit from spring until frost. Mrs. Hamilton takes charge of the "pick-your-own" customers. They harvest 95 percent of the fruit produced on the farm. Hamilton's conservation work has helped increase apple yields from 2,000 to 6,000 bushels. Strawberry yields are 5,000 quarts. The raspberry crop last season yielded 2,000 pints.

"We plan to continue expanding our operation," Hamilton said. "The children are growing up and help a lot. Thanks to my soil conservation plan, I now have the fruit production I need to assure steady and repeat patronage."



Contour stripcropping without terraces on the Charles McIlwain farm in Abbeville County, S. C.

No Terraces—Just Contour Strips

By Brice M. Latham

CHANGE—that's what you will find taking place continually in the soil and water conservation program. And that's what you will find on the Charles McIlwain farm in Abbeville County, South Carolina, where there isn't a single terrace—they used to be there, but have been eliminated. Contour strip rotations, with strips 72 feet wide, are used instead of terraces. Every other strip is in small grain. This system gives adequate rotation to protect the Class II land and at the same time, if properly laid off, will give all long rows.

Mr. McIwain says, "If you are not going to follow a good strip rotation that will protect the land, you had better stick to terraces." McIlwain has been following this system for 3 years and he likes it fine. He says, "I wouldn't go back to the old system. I put in 20 more acres this year." McIlwain is a cooperator of the Abbeville County Soil Conservation District and a conservation aid with the Soil Conservation Service.

With the parallel strips, McIlwain uses every natural depression for a grass waterway. The acreage used, however, is less than that originally used in conventional meadows. The meadows used for drainage are small and the cultivating equipment can cross them without difficulty. He just elevates the plow blade when he comes to one, crosses the meadow and continues the cultivation of the crops.

"This system of contour strip rotations without terraces is a farmer's dream," says McIlwain. "No terraces to cross, no terraces to maintain, and all long rows."

Note:—The author is area conservationist, Soil Conservation Service, Anderson, S. C.

Change and Conservation Progress in 1959

By D. A. Williams

TODAY the one thing we can be sure of, in conservation as in all other activities, is change—constant, relentless change. The world about us is changing so rapidly that even with instanteous communications we are taxed to keep abreast of the times.

Scientific progress often renders a product almost obsolete before its mass production process is perfected. The shifting agricultural economy—with larger farms, more mechanization, vertical integration, and greater emphasis on management skills—poses problems to the Soil Conservation Service as well as to other agencies.

Despite the increasing technical complexity of today's living, the appreciation of the role of natural resources is growing. Thinking people in all walks of life are coming to realize that most of the great developments of our time could ultimately be meaningless if we do not maintain our resources base.

Advancing technology in agriculture as in industry requires us constantly to reexamine the role of soil and water conservation in our national life and to see that conservation technology keeps pace with its allied arts. We must interpret soil and water conservation in terms of today's realities—not yesterday's.

This leads us to a broadened concept of conservation. It no longer suffices merely to point with alarm at the specter of soil erosion and water waste. We must show how to use our land resources more efficiently to meet the needs of our growing population—today and on into the future.

Land use choices today cannot be made simply in terms of production potentials and needs. "Space" uses of land compete increasingly with agricultural production. Extending urban settlements, highways, and other nonfarm uses are covering an estimated million or more acres a year. At the same time people with more leisure and better incomes need more land for parks, forests, lakes, wilderness, and other recreational purposes. Land use patterns, therefore, must be constantly adjusted to supply both material and nonmaterial needs of our people, and the soil and water conservation problems created by these uses must be dealt with.

Improved technology, including that of soil and water conservation, must be depended on to feed and clothe an estimated 230 million people in the United States by 1975, and 370 million by 2010, from approximately the same acreage of agricultural land as is in use today. The Agricultural Research Service recently pointed out that to meet 1975 demands "we must devise improvements 30 percent faster than we did during the fruitful 20 years preceding 1956."

To develop a technology equivalent to the projected need of 400 million acres of additional land by 2010 "will require improvements in farm practices at a rate 160 percent as great as in the past two decades."

Granted that there is no visible limit to the ingenuity of man, we cannot suppose that improved agricultural technology can bear fruit without the land and water to which it can be applied. Those resources, which do have definite limits, must be kept intact for the successful exploitation of man's ingenuity.

This is the setting in which the soil conservation job must be carried forward. The following paragraphs recount some of the Soil Conservation Service activities in fiscal year 1959 to fit into that situation and to keep in step with ever-moving modern technology, thought, and needs.

Note:—This article is a digest of a report for the fiscal year 1959 submitted to the Secretary of Agriculture by D. A. Williams, Administrator of the Soil Conservation Service.

Conservation Needs

A look at the soil and water conservation job ahead is contained in results of the National Inventory of Soil and Water Conservation Needs being conducted by 8 agencies of the Department of Agriculture.

This inventory will provide specific information about the land and water resources of every county in the United States and estimates of soil and water conservation needs in terms of the land use, population, and economic conditions expected in 1975. It will include an inventory of watershed project needs.

The Soil Conservation Service is responsible for leadership in making field surveys and assembling and analyzing data, in cooperation with inter-agency committees in every county and State. The work of county committees is scheduled for completion by January 1, 1960. Progress to June 30, 1959, was on schedule in most States. Mapping of soils and land use on representative sample areas was completed in all but a few counties.

Soil Surveys

Soil surveys give a factual picture of land use capabilities and conservation needs as a scientific basis for planning soil and water conservation for a farm, ranch, watershed, or other land area. They are also used increasingly for nonagricultural purposes such as city and suburban land-use planning and in highway and building construction.

Although agricultural production and other land uses are limited by the natural potentialities of the soil, modern technology makes it possible to modify soils in many ways. In fact, the most efficient agricultural production requires soil and field conditions different from the natural state of most of our land. Soil surveys not only show the natural limitations of each soil but indicate the degree to which desirable changes are feasible with new farming and conservation methods.

Mapping Progress—More than 615 million acres have been mapped to date in sufficient detail for conservation planning. This is about half the agricultural land in soil conservation districts and 30 percent of the total land area of the United States.

In fiscal year 1959 field mapping covered about 48,000,000 acres, compared to 41,094,326 in 1958. This is an increase of 16.9 percent.

A total of 1,538 "standard" soil surveys—i.e., meeting rigid requirements of the National Cooperative Soil Survey—were underway by June 30, about 660 of them on a "progressive' basis.

Cooperation with Other Agencies—The SCS expanded its cooperative work with the Bureau of Public Roads to obtain information on the engineering properties of soils. Seven additional State highway department laboratories agreed to do testing work, bringing to 18 the number of States cooperating.

Results of these tests are included in soil survey reports and are used immediately by SCS engineers and others working in soil conservation districts and watershed treatment projects.

Results of this work are also provided to the Federal Housing Administration for use in appraising building sites and designing construction.

An increasing number of areas in the National Forests are being surveyed cooperatively by the Forest Service, SCS, and land-grant colleges. Forest Service soil scientists do most of the field mapping and the Soil Conservation Service correlates the soil classification.

Soil Classification and Correlation—Work has continued on revision of the nationwide system of soil classification. Trial groupings of soil series into classes in each of the five higher categories were reviewed and revised and are being tested further. Plans are to have a preliminary publication of the revised system available at the time of the Seventh International Congress of Soil Science to be held in this country in 1960.

Field studies have been made in a number of places to achieve better interstate correlation and greater uniformity in the description and definition of soils. Joint studies of classification problems and series concepts were made with Canadian soil scientists across the borders between Ontario and Michigan and between Quebec, Maine, and New Brunswick.

Soil Survey Reports—Thirty-four edited soil survey reports with accompanying map materials were sent to the Government Printing Office during the year. This makes a total of 63 reports in the Government Printing Office awaiting publication. Thirty-seven soil survey reports were published in 1959 as compared to 16 reports in 1958.

Most of the soil survey reports sent to the printer during the year contained engineering sections prepared jointly by engineers and soil scientists.

Improved sections on climate are being prepared for soil survey reports. The Weather Bureau is assisting in making predictions of the probability of frost damage, low rainfall, or other statistics important to the area. This data can be interpreted in terms of crop production, crop selection, soil loss under specified management, or used for other purposes.

Practically all of the soil survey reports now being published contain basic soil interpretations; the soil map is on a photomosaic base. The Service is making an effort to use published soil survey reports in farm and ranch planning and to key the soil maps and interpretive material to technical guides.

Soil Interpretation—Basic soil interpretations are needed for use in woodland planning and in assisting woodland owners to select the best conservation practices for different kinds of soil. Emphasis is being placed on coordinating soil-woodland site index data between States. As a result, several States are now developing special reports summarizing soil-woodland interpretations.

Soil Survey Laboratories—The work of the laboratories continued to grow during 1959. Complete physical and chemical characterization studies were completed on 4,500 samples from 649 described profiles from 155 counties in about 45 States and Puerto Rico. Between 50 and 60 reports containing field observations, laboratory data, and interpretations were issued or are being assembled. In addition to these characterization projects about 1,000 samples were run as texture checks and for other special purposes.

The laboratories continued to collect and prepare soil, vegetation, and animal samples from the United States and various locations over the rest of the world as part of the study of the distribution of radioactive strontium. A comprehensive report of the results was prepared in May. A new laboratory building was constructed at Beltsville with Atomic Energy Commission funds to house the sample preparation and analytical work done for the worldwide survey of fallout materials.

Field Studies—Field studies of soil-geomorphology relations in desert areas were conducted near Las Cruces, New Mexico. Eight major geomorphic surfaces were delineated and bedrock and surficial sediments determined. This study is increasing our understanding of the erosion processes in deserts.

Studies were continued on (1) the cobalt status of soils in several Southeastern States, (2) molybdenum toxicity in Nevada, (3) the micronutrient status of soils of the Northeastern States, (4) criteria for classifying organic soils, (5) soil-vegetation studies to aid in soil mapping and soil interpretation in extensive grassland and woodland areas, and (6) causes of gullies in western Iowa. The study of long-time relationships of crop yields to climate and soil types in the Great Plains was continued.

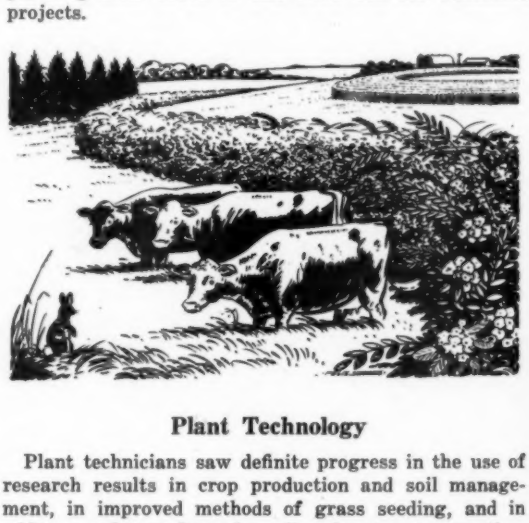
World Soil Map—The World Soil Map group continued its basic soil mapping across several countries. Major emphasis was given to new interpretations of both new and old mappings. Collection of information on world-wide geography of soils was continued along with some special effort on those elements in soils important in radioactive contamination.

Compilation of a new 1:5,000,000 soil map of the United States was started.

Cartography—The cartographic units in 1959 provided an increasing amount of assistance in connection with small watershed protection projects and continued to provide facilitating service for conservation operations.

Soil maps for 43 counties and projects were completed and as of June 30, 1959, the press negatives were ready for the printer. In addition, 141 other counties or projects were in some stage of work in the cartographic units.

The Service produced 361,399 prints of soil and land capability maps for 131,994 farms and ranches and 454,166 prints of conservation plan base maps for 156,902 farms and ranches. In addition, the cartographic units provided 13,702 engineering drawings, 8,046 planimetric maps, topographic maps covering 275,179 acres, aerial photographic mosaics covering 11,539,988 acres, 203,104 aerial photographs, and other miscellaneous planning aids. Much of this work was for watershed projects.



Plant Technology

Plant technicians saw definite progress in the use of research results in crop production and soil management, in improved methods of grass seeding, and in wider use of new plants for soil and water conservation.

Cropland Planting—"Plot planting" and "wheel-track planting" are examples of new methods of producing crops that not only reduce soil and water losses, but also provide better weed control, require fewer tillage operations, and reduce cost of production, all with no decrease in crop yields. These practices have been widely adopted by farmers in parts of the Corn Belt.

Range Seeding—New equipment for seeding grass in sandy rangeland covered with sagebrush and weeds was developed for use in several soil conservation districts in southwestern Kansas.

The new planter consists of a toolbar on which two lister-type shovels and individual seed hoppers were mounted 42 inches apart. This equipment reduced competition from sagebrush and weeds enough to permit

the new grass seedlings to become established without increasing the wind erosion hazard. During the past 2 years more than 100,000 acres of depleted sandy rangeland has been successfully seeded with this tool.

Nationwide, the amount of range seeding in soil conservation districts increased 31 percent over the preceding year to reach a total of 1,696,000 acres.

Water control for woodland management—During the year SCS engineers, soil scientists, and woodland conservationists worked together to develop guides for the control of surface water in coastal woodlands. About 12 years ago the Service undertook field observations on areas where structures had been built to stabilize water levels or otherwise control surplus surface water as a management practice in wet woodlands. Since then the practice has spread into the lower and upper coastal plains of the southeastern States until it is now being used by many landowners, both large and small. Preliminary conservation needs estimates show that there are approximately 45-50 million acres of woodland on which water-level control is needed.

Farming for waterfowl—During the year significant progress in the improvement of private lands for waterfowl in the southeastern States and on the Pacific Coast has given promise of more waterfowl wintering habitat, improved facilities for waterfowl harvest to meet increased demand from hunters, and an economic return to farmers and ranchers.

This is being achieved by "farming for waterfowl," a term used to describe modern farming technologies employed in the development and management of tillable lands for the annual production of a dependable, high-quality food crop for waterfowl, replacing the hit-or-miss methods of the past.

Coordination of specifications—Continued progress was made in coordinating specifications across State boundaries where similar soil and agricultural conditions exist. This was done in many places and in various phases of plant technology. It is well exemplified by the results in the Great Plains, where all States now use the same specifications for stubble mulching. Determinations of wind erodibility and wind erosion control methods are also comparable now in the different Plains States.

Better Plant Materials—Further testing of several new varieties of grasses and legumes, and extended uses for some old varieties, advanced the use of specialized plant materials for soil and water conservation.

Seed of a vigorous strain of bermudagrass, NK-37, was placed on the market for pasture and hay in the Southeast, and a local strain of native switchgrass, Pangborn, proved superior for use in gullies.

Big trefoil and creeping bentgrass proved valuable for stabilizing ditch banks in the Northeast, and field brome was very effective as a soil cover in steep orchards. Two native panicu-grasses, *P. amarum* and *P. amarulum*, were effective as sand binders for dune stabilization and shore protection.

In the Corn Belt States, the use of field brome was extended as a cover crop in corn and in fruit orchards. Sand lovegrass, a native of the Great Plains, proved useful in stabilizing blow sand in eastern Iowa and western Illinois, and mountain brome was used successfully as a cover crop in commercial hybrid corn seed production in Illinois.

In the Great Plains an annual inventory of the need for grass seed enabled producers to plan production and harvesting schedules and helped to assure a more adequate supply of the species needed for critical revegetation work. Marked progress was made in the production of many of the grass seeds that had not been available on the market.

At the National Plant Materials Center at Beltsville, Md., approximately 800 new accessions of plants were received and processed, most of them from foreign lands, and some 1,100 packets of seed were distributed, of which 300 packets went to 30 foreign countries, partly in return for seed obtained from them. The five new plant materials centers authorized year before last are all now in full operation.

Engineering

Erosion Control Practices—The trend toward larger farm equipment and the shortage of farm labor is creating new problems in planning terrace systems. Better terrace alinement received further attention during the past year and "parallel" terrace systems are gaining in favor. Studies were started to determine the relation of required terrace spacings to the use of other recommended practices such as contour cultivation and conservation cropping systems.

Drainage—Service engineers worked with manufacturers of drain tile on quality criteria and inspection methods. The American Society for Testing Materials issued specifications for a new class of concrete drain tile known as "special quality" for use in acid and alkali conditions. SCS engineers also assisted ASTM in setting up criteria for a new class of clay drain tile, "heavy duty," for use where external loading exceeds that allowable under existing specifications.

Conservation engineers helped with the evaluation of organic filters surrounding drain tile in western Washington and subsurface and salinity problems in Texas. They set up field trials in New Jersey to record the discharge of tile drains and observe the drawdown of groundwater between drains. In the southeast trials of a new type of narrow, deep field drain gave favorable results.

Hydrology—The Service gave major emphasis to improving hydrologic techniques of watershed planning, including consideration of more alternates in structural location and design.

Projects being carried out under a memorandum of agreement with the Weather Bureau are providing improved information on rainfall intensity-frequency regimes and probable maximum precipitation that will provide the basis for improving criteria for the design of class b and c dams.

Activities being carried out under a memorandum of agreement between the Service and the Geological Survey are: (1) A tabulation of peak discharge and storm runoff volumes for 2,445 selected gaging stations; (2) a study of reservoir inflow hydrographs of many pond gage installations operated by the Geological Survey; and (3) a study of flood routing methods.

Snow Surveys and Water Supply Forecasting—Cooperative relations with Federal, State, and private agencies were augmented by new cooperative agreements with the University of Arizona covering research to improve forecasting procedures; with the State Engineer of Oregon to support collection of data in Oregon; and an international agreement with the Province of British Columbia to cover the mutual exchange of snow-survey data in watersheds divided by the international border.

Several additional water-supply forecast bulletins for individual soil conservation districts were started. In four states—Oregon, Nevada, Idaho, and Wyoming—practically all soil conservation districts now receive these locally-oriented bulletins.

Installation of radios for over-snow machines continued. In one instance in Idaho when an over-snow machine had a mechanical breakdown the availability of radio equipment resulted in savings amounting to the initial cost of all radio equipment in the State.

The use of automatic electronic computers in processing snow-survey data was started this year in Montana and Colorado. The Agricultural Research Service began a study to improve snow measurements by mechanical and electronic means that may eliminate the need for snow surveyors to visit the snow courses to record data.

Design and Construction—Design sections of the Service prepared detailed construction plans and specifications during the year for work estimated to cost about $25,300,000, an increase of 87 percent over the previous year. Most of this work was for watershed operations. Fourteen State design offices are now in operation, primarily on preliminary design.

A start was made in the use of engineering services contracts to augment the work of Service engineers in planning and operations. To date, a total of approximately $795,000 has been expended in negotiated engineering contracts.

Irrigation—Increased irrigation activity in small watershed projects under PL-566 has required the review of SCS techniques, procedures, and policies to better adapt them to this new phase of Service work. River basin studies requiring estimates on irrigation water requirements of the Delaware, Potomac, and Huron rivers and Upper Colorado River have also presented new problems requiring the development of different techniques and procedures.

Land leveling and surface irrigation have continued to expand in the eastern United States. A total of 526,528 acres of land leveling was completed during the year. This was a gain of 14 percent over the preceding year.

The control of erosion on irrigated land in the higher rainfall areas of Kansas, Nebraska, and South Dakota by contour bench leveling is progressing satisfactorily.

Handbook Materials and Standards—Handbook materials and technical guides on many phases of soil and water conservation engineering were prepared and issued during the year. These materials provide a growing body of uniform instruction for engineering work throughout the United States.

Interagency Cooperation—The Service continued to cooperate with the U.S. Geological Survey in collection of basic data on trap-efficiency of floodwater-retarding reservoirs and with other Federal agencies in collection, analysis, and interchange of sedimentation data.

The SCS worked closely with the Corps of Engineers of the Army, especially in the Mississippi Valley, in coordination of design criteria so that farmers would benefit to the fullest extent by the drainage work of the two agencies.

The Agricultural Research Service, Soil Conservation Service, and Bureau of Reclamation continued a coordinated 5-year study of methods for estimating the effects of land use changes and treatment on the yield of water by streams and rivers.

Soil Conservation Districts

Conservation technology becomes effective on the land mainly through the medium of soil conservation districts and their farmer and rancher cooperators.

Soil conservation districts, as local units of State government, have the job of pulling a wide variety of conservation programs and interests together into one program that effectively attacks local soil and water problems.

Since the primary job of the Soil Conservation Service is to provide technical help to farmers and ranchers through their soil conservation districts, the SCS took several steps to improve working relationships with districts.

One step was a restatement of the Service's long-standing policy toward districts and their business affairs. Another was the publication of a joint Program of Action developed by representatives of soil conservation districts and the SCS. The Program of Action emphasizes the responsibilities of each organization and suggests methods by which districts can make more effective use of technical facilities of SCS.

The SCS also encouraged districts to make use of the Department of Agriculture's conservation loan, cost-sharing, commodity, extension education, and other programs where they could be used to advantage.

The Service in fiscal year 1959 provided technical help to 2,847 of the 2,861 districts in the 50 States, Puerto Rico, and the Virgin Islands. These districts include

about 95 percent of all the farms and ranches and cover more than 90 percent of the farmland of the nation. Seventy-two new districts were organized during the year and 17 were dissolved, giving a net increase of 55 for the year.

Districts added 113,351 new cooperators during the year, but cancellations reduced the gain to a net of 65,028. At the end of the year, 1,859,439 farmers and ranchers operating 563,743,296 acres were cooperating with their districts. About half of these farmers and ranchers received technical help from the Service during the year.

In addition, the SCS provided technical assistance on 2,647 water-management group enterprises, each involving several landowners in a soil conservation district. These group projects dealt with irrigation, drainage, or other water problems affecting 23,087 farms and ranches and benefited 1,847,000 acres.

Farm and Ranch Planning

Soil conservation district cooperators developed 92,800 new basic conservation plans during the year covering 29,386,204 acres. In addition, 15,572 district cooperators revised plans on 8,613,472 acres to include improvements in conservation methods or adjustment to changes in economic conditions. Altogether, this makes 1,279,634 farms and ranches, embracing 365 million acres, having basic plans.

In assisting district cooperators with conservation planning, the Service emphasized that a basic plan is not a "format" but a concept or idea of sound soil and water management. It is the image, on paper, of the conservation methods which a farmer or rancher decides he wants to use once he has sound technical information and understanding of his land's needs. The plan is not an end in itself, but only the beginning of effective conservation farming or ranching.

Rurban Planning—Many soil conservation district governing bodies have adopted a policy of giving limited assistance to landowners who are nonfarmers. This is especially true in the Northeast and on the West Coast where large areas have gone into suburban and industrial developments, often leaving much land in an in-between state of partial use or nonuse that is neither rural nor urban.

The Service in 1959 announced a policy of working with soil conservation districts on "rurban" problems and made arrangements to provide technical information and assistance on request. The assistance consists largely of supplying information about soils and their interpretations, advice as to proper treatment and management of land, and guidance on problems of flooding, drainage, and other types of water management. Such help usually has a lower priority than help to active farmers or ranchers.

Land Treatment

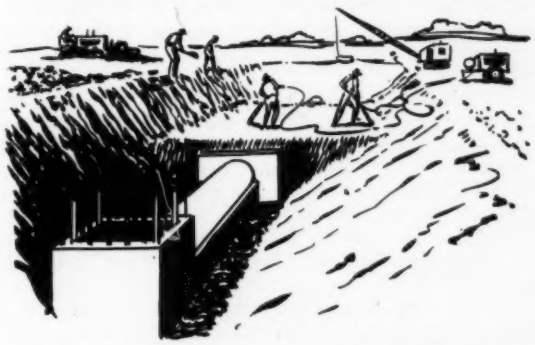
Plans by themselves neither protect nor improve soil nor conserve water. The landowner's or operator's decisions must first be acted upon and the planned measures applied to the land.

Although a single practice seldom accomplishes much by itself, the sum of conservation practices applied to the land according to well-laid plans is a good measure of conservation progress. The Soil Conservation Service in fiscal year 1959 gave assistance to 896,382 district cooperators in putting their conservation plans into effect.

The following table summarizes some of the accomplishments in land treatment.

Conservation practices newly applied in soil conservation districts, with SCS assistance, 1959.

Contour farming	acres	2,070,458
Conservation crop rotation	acres	6,495,194
Cover cropping	acres	3,116,221
Stripcropping	acres	727,663
Stubble mulching	acres	3,274,246
Terracing	miles	46,011
Waterway development	acres	65,573
Pasture planting	acres	3,065,153
Range seeding	acres	1,696,193
Tree planting	acres	1,046,956
Wildlife area improvement	acres	536,815
Drainage improvements	acres	1,756,801
Land leveling	acres	526,528
Improved water application	acres	1,165,984
Pond construction	number	66,809



Watershed Protection and Flood Prevention

The small watershed is becoming widely recognized as a practical unit for soil and water resource protection, development, and management.

Structural design and installation in watershed projects is of such a scope that individual landowners cannot install the measures with ordinary farm equipment. Recent advances in earth and concrete construction and improvements in equipment for earthmoving and shaping have opened up new possibilities of agricultural watershed protection.

The acre-by-acre and farm-by-farm conservation treatment of land above watershed structures continues to be a fundamental requirement of watershed treatment. As in the past, this land treatment work is accomplished mainly through soil conservation district operations.

Community Watershed Projects—The Service worked with State agencies responsible for approving Watershed Protection and Flood Prevention projects under Public Law 566 to develop mutually acceptable principles for establishing priorities of work.

Standards for judging the soundness of watershed projects are being strengthened and more careful investigations of costs and feasibility are being required to assure watershed programs of real public benefit. Care is being exercised to discourage requests for approval of projects that will benefit only a few landowners or that represent an unusually high cost per acre.

Applications for planning assistance under PL 566 were received from 261 watersheds during the year. At the end of the year, 47 States and one territory had submitted a total of 1,148 applications for Federal assistance in planning.

During the year, 82 applications were approved for work plan development. This brought the total watersheds approved for planning to 446 in 47 States and one territory. At the end of the year, planning had been suspended or terminated in 67 watersheds. These suspensions or terminations were at the request of the local organizations or with their concurrence.

The Forest Service, Bureau of Land Management, and Bureau of Indian Affiairs assisted with watershed planning where problems required such assistance.

In eight States, additional planning assistance amounting to more than $600,000 was provided through trust fund agreements, reimbursements, State-controlled planning parties, or personnel provided by the States.

Public Law 566 was further amended by the 85th Congress to provide for recognition of the conservation and development of wildlife resources in watershed projects and to authorize the Secretary of Agriculture to provide cost-sharing assistance to local organizations for fish and wildlife development as a part of projects. Policies and procedures for carrying out the provisions of these amendments were formulated and placed in effect.

Installation of works of improvement was given in two stages: (1) "Approval for advanced engineering and other technical assistance," and (2) "Approval for construction of structural measures." The first stage authorizes the use of Federal funds to make surveys, prepare designs and specifications, and for technical assistance to plan and apply land treatment measures. Approval for the second stage provides Federal funds to negotiate a project agreement for construction work.

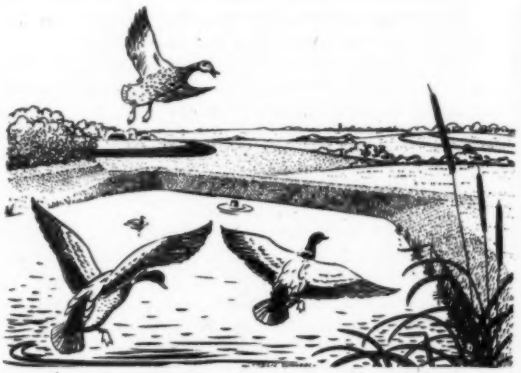
During the year, 80 projects were "Approved for advanced engineering and other technical assistance" and 60 projects were "Approved for construction of structural measures." This brought the total projects approved for Federal assistance in the installation of works of improvement to 180. Of those, 107 are "Approved for the construction of structural measures."

Watershed Protection (Pilot)—There were 39 active pilot watershed projects this year.

Eight projects were completed during the year except for project evaluations and completion reports.

It is estimated that a total of 30 projects had all structural measures completed and seven additional projects had the planned structural measures more than 90 percent completed at the close of the fiscal year.

Flood Prevention—Work plans were prepared for 12 subwatersheds and 8 subwatershed areas in the 11 watersheds authorized for flood prevention work. This makes a total of 179 subwatershed work plans and 16 subwatershed area work plans completed to date. Structural work and land treatment continued at a satisfactory rate in these subwatersheds.



Assistance to the States—During the year specialized technical assistance was provided on request to State agencies in Mississippi, Tennessee, Kentucky, and Maryland in developing reports on water problems and plans and procedures for studies of water problems and water rights. Summaries were prepared of the progress in water policy and program legislation in Alabama, Arkansas, Florida, Georgia, Mississippi, Tennessee, and North Carolina.

Field studies were made of a number of watershed protection projects with respect to water rights problems in Louisiana and Colorado.

River Basin Investigations—The Service joined with other agencies of the Department in improving procedures for coordinating studies and exchanging information between the many agencies, both Federal and State, interested in water problems of large river basins.

The Inter-Agency Committee on Water Resources issued a policy statement on the subject, and the SCS followed up by developing procedures for distributing information and coordinating review within the Department of Agriculture of survey reports from agencies outside the Department.

Investigations were underway during the year in the following river basins: Delaware, Potomac, Lower Mississippi Tributaries, Yazoo-Mississippi, Kansas, Colorado River Storage Project, Haw, Upper Mississippi and Great Lakes, and Huron. Comments were developed for the Department on 12 proposed reports of the Corps of Engineers, 3 of the Bureau of Reclamation, and 1 of the Department of State.

Great Plains Conservation Program

Farmers and ranchers entered into 2,316 contracts under the Great Plains Conservation Program in the fiscal year. These contracts cover 5,955,000 acres on which the operators agreed on basic conservation plans aimed at stabilizing agriculture through better land use and conservation measures with the aid of long-term cost sharing. Cumulative totals as of June 30, 1959, were 2,886 contracts covering about 7.8 million acres.

On June 30, 1959, 340 countries in 10 States were authorized to participate in the program. Demands for help exceeded the $10 million annual appropriation available.

During the year a total of 4,243 applications were received for assistance on 13.8 million acres. At the end of the year a workload of nearly 3,000 applications covering about 11 million acres was on hand.

Planned conversions of cropland to other uses, mainly range, during the year totaled 190,000 acres, or 27.8 percent of the total cropland acres at the time contracts were prepared. Nearly 119,000 acres of this total were planned for cost sharing under the Great Plains Conservation Program and more than 71,000 acres for cost sharing under other programs. The planned cropland conversions since the beginning of field operations in December 1957 totaled about 263,000 acres, or 29.5 percent of the total cropland at the time plans were prepared.

In many areas the success of the Great Plains Conservation Program depends largely on the extent and success of range reseeding. A total of about 235,000 acres of range reseeding was planned during the year, bringing the total planned to date to 361,000 acres.

Other Programs

The Service gave direct assistance to Rural Development Program activities in 67 counties to which special funds were allotted. This aid amounted to a total of approximately 90 man-years, principally for soil survey and conservation farm planning technicians. They gave an average of 1½ man-years' service to Rural Development Program areas (some of more than one county) in 29 states and Puerto Rico. This assistance was in addition to regular Service technical help to soil conservation districts which also include Rural Development Program land owners or operators.

The Service continued to assist Agricultural Conservation Program participants with permanent-type practices on which cost sharing was requested. Such assistance was provided on about 361,000 farms and ranches.

The Service provided technical assistance to about 9,300 participants in the Conservation Reserve Program of the Soil Bank. This included general counseling as well as direct assistance in selecting lands for contract and installing treatments for long-time protection.

Assistance to the Farmers Home Administration in its conservation and watershed loan programs continued.

An Editor becomes a Conservationist

By Ovid Neal

HERB KARNER—Farm Editor for the *Tulsa World*—is a man who writes good, "down-to-earth" stories about the land and the people who live on it. These stories are rich and full because the writer has lived through many experiences akin to those of the farmers about whom he writes.

Eight years ago the Karners bought an 80-acre farm in Wagoner County, Okla. When the Karners moved onto it, the farm was "not a pretty sight." It consisted of 40 acres of worn-out, badly eroded cultivated land, 25 acres of unmanaged woodland and wasteland, 5 acres of native meadow, and 10 acres of almost worthless pastureland. The cultivated land was cut by numerous gullies that were too big and deep to cross with farm equipment. The pasture was made up mostly of weeds and did not furnish more than enough grazing for one cow. Two large drains crossed the farm. The areas covered by these drains were wasteland.

In 1952, Herb became a cooperator with the Wagoner County Soil Conservation District.

Note:—The author is a former Soil Conservation Service engineer, now retired.

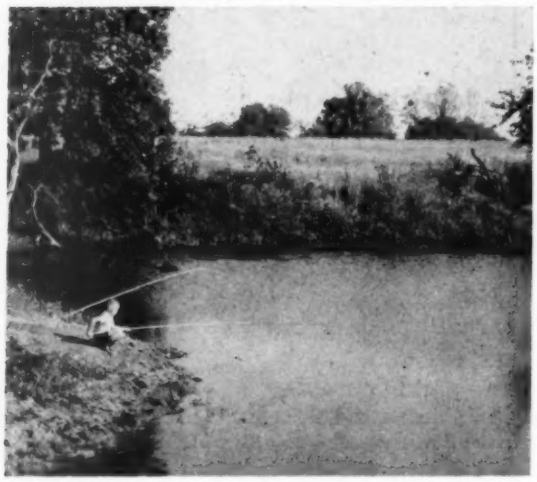
Herb Karner and son with solar laying house in background.

Diversion terrace covered with bermudagrass on the Karner farm.

Technicians of the Soil Conservation Service furnished technical information and assistance in working out a soil and moisture program adapted to Herb's farm. It wasn't too difficult to work out a plan with Herb. He had his conservation route pretty well mapped: laying hens and pasture development. All that would be required to do the job was a lot of work on the part of the farm team, which consisted of Herb, Mrs. Karner, two boys—Gary 15 and Kenneth 5, and one girl—Valarie, age 12.

In 1953 when the team took the field things began to happen. Diversion terraces were surveyed and built, a farm pond was staked and built, gully treatment was begun, Bermuda sod was planted in the gullies, Bermuda sprigging was done on the pastureland, and a waterway was laid out and built. The waterway has made it possible to complete reclamation of former wasteland. This area is now tied down with excellent bermudagrass pasture.

The fish-stocked pond on the Karner farm.



The Karners started out with 340 laying hens. They have expanded their poultry business to their present flock of 5,200 layers. Is the poultry business profitable? Karner will tell you, "Yes! But speaking of profit, what about that 10 tons of chicken manure that I haul out every month?"

The bermudagrass pasture has the answer for this. Luxuriant native and Midland bermudagrass grows knee high in many areas. This bermudagrass is mixed with Ladino clover, big and little hopclover, sweetclover, Korean lespedeza, and vetch. Now 14 beef cattle, two dairy cows, a heifer, and a horse enjoy this good pasture. Every acre on the farm is serving a useful purpose. The farm pond is stocked with fish. There is plenty of fish in the deep freeze and fish for the neighbors besides.

The woodland near the main draw and native meadow gives protective shelter to the livestock during the winter months. It constitutes an excellent wildlife habitat, harboring rabbit, squirrel, quail, and songbirds.

The gully-treatment work is almost completed; and, with the exception of a small area, the scars of erosion are completely healed with a cover of useful pasture plants.

From what I have seen and from what Herb has told me, I know that this conservation venture has been fun; but, interspersed with the fun, there was much vision, great perserverance, and a lot of hard work.

SCS helps locate a new highway

The New Jersey Highway Department recently asked the SCS State office to help locate a new highway so that the least damage would be done in taking good farmland out of production and dividing farms into parcels that would be uneconomical to operate.

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It usually isn't the amount of rain that causes erosion, it is how fast it falls.

DISTRICT PROFILE

ISAAC THOMAS of DELAWARE

AROUND his home town of Marydel, Isaac Thomas is known as "Ike." Over his native state of Delaware he's often called "Mr. Conservation." He acquired the latter name for his pioneering work in soil and water conservation, both on his farm in Kent County and in the State capital at Dover.

Ike grew up with the conviction that conservation farming pays handsome dividends in the long run. With this belief and no more agricultural training than a high school Vo-Ag course, he became a leading farmer in his State.

Ike Thomas started farming on his own with a 140-acre piece of land his father gave him. Today he operates 500 acres of tillable land plus more than 400 acres of good timberland. His 926-acre farm, covered by four conservation farm plans, is considered one of the finest dairy operations in Delaware.

Thinking back to the earlier days, Ike said: "Some of this land was knee-deep in water every spring. We couldn't work the land until midsummer. After we added the drainage system, the land was dry enough to give us time to get three cuttings of hay."

During a summer dry spell several years ago. before pasture irrigation became popular, Ike devised a makeshift irrigation setup by using an old pump, some garden hose, and water from a tax ditch. He saved a good pasture seeding from being burned out by the drought. Now he has an up-to-date system that he holds in reserve for dry periods.

Ike put his woodlot to good use a few times during the 1940's. A new house, built for his growing family, was made of timber from the farm. A few years later he built a modern barn, also made of timber from the Thomas farms.

The new house and barn needed fire protection. There was a wet spot behind the house, not too far from the barn. It was partly drained by an old tile line but still was too wet for grazing. SCS-designed farm ponds were something relatively new at the time, but Ike wanted to try the idea. So SCS technicians designed a ¼-acre pond and used the tile line for an outlet.

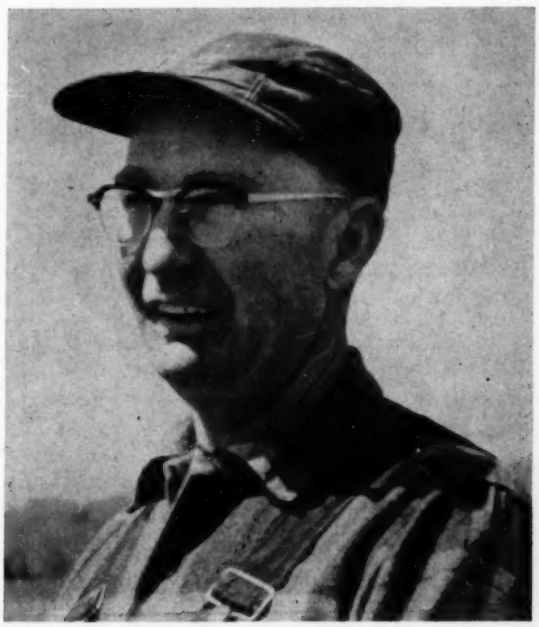
A good rotation, plenty of fertilizer, and seedings of improved grasses and legumes have made Ike's hay production one of the highest in the State. He sells more than 4,000 bales of extra hay each year. His herd of 65 mixed milkers has one of the highest production records in the area.

The conservation farm plan includes a good wildlife angle, too. Lespedeza is planted along all new ditch banks and in odd areas. Ike notes: "The lespedeza makes good food and cover for small game and it does a good job of holding the new ditch banks."

Ike added a 200-acre abandoned farm to his operations three years ago. In less than three years he cleared away scrub trees and an old orchard, installed a new drainage system, then cover cropped and fertilized for two years to build up the soil. Now he has a beautiful stand of orchardgrass and red and Ladino clover on it.

In 1941 Thomas served a term as representative in the General Assembly of Delaware. There he worked for the passage of the enabling

Isaac Thomas



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legislation for creation of soil conservation districts in Delaware.

When landowners created the Kent County Soil Conservation District in 1943, Ike was elected a member of the board of supervisors. At the first meeting of the district organization, he was made president. Subsequently, he was elected district treasurer, a position he still holds.

In 1955 Ike was elected vice president of the Delaware State Association of Soil Conservation District Supervisors and served two terms. He was elected president of the State association at the 1957 meeting and served two terms in that office. Ike's latest SCD assignment is council representative for Delaware in the National Association of Soil Conservation Districts.

In 1954 the Governor appointed Ike an agricultural member of the Delaware Water Resources Study Committee. Last fall he was appointed a member of the State ASC Committee for a three-year term.

In addition to his official conservation duties, Ike is a member of the Grange, Lions Club, Farm Bureau, and Eastern States Farmers' Exchange. He has been a community 4-H club leader for years.

—GORDON S. SMITH

Coastal Bermuda Corn Rotation

A new way to manage a rotation of Coastal bermudagrass and corn so that the grass will reestablish itself after the corn crop has been developed by the Georgia Experiment Station and the Agricultural Research Service. The 4-year rotation includes 3 years of Coastal bermuda and 1 year of corn and should be highly effective in controlling erosion on erodible lands.

Once the bermudagrass is well established on a field, the stand is not entirely destroyed by tilling for the following corn crop. After the corn is planted, the grass begins to recover and forms a good sod before the corn is harvested. This means that the surface of the soil is unprotected for only about 3 months during the 4-year rotation, and a good hay crop can be cut during the first year after the corn is harvested.

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The Soil Conservation Service had 14,608 full-time employees at the end of the fiscal year 1959, compared to 14,478 a year before. In the Washington area there were 432 employees, compared to 474 a year before.